$t = t_0$

$t = t_0 + t_1$

FIG. 1a

FIG. 1b

FIG. 2

Cross-Correlation Coefficient Planes

FIG. 3b

Interrogation Areas of Image

FIG. 3a

202 — CBC AT HIERARCHY LEVEL S

204 — INPUT: 4 correlation tables from adjacent interr. areas

$R^S_{i,j}$, $R^S_{i,j+1}$,

$R^S_{i+1,j}$, $R^S_{i+1,j+1}$

— 200

206 — Identify signal peak by element-by-element multiplication of the Rs

$CBC^S_I = R^S_{i,j} \cdot R^S_{i+1,j+1}$

$CBC^S_{II} = R^S_{i+1,j} \cdot R^S_{i,j+1}$

208 — $max(CBC^S_I) = \; = max(CBC^S_{II})$?

216 — Combine correlation planes

$R^{S+1}_{p,q} = R^S_{i,j} + R^S_{i,j+1} + \; + R^S_{i+1,j} + R^S_{i+1,j+1}$

n

y

210 — Search for the signal peak on $R^S_{i,j}$ in the neighborhood of the tallest peak of the CBC planes.

218 — Mark the interrogation area at (i,j) as unfinished for the next hierarchy level (p,q)

212 — Peak found in $R^S_{i,j}$?

n

y

214 — END OF CBC at (i,j)

FIG 4a

FIG. 4b

Combining interr. areas (S=4)

Interrogation areas in the 1st image frame

Enlarged interrogation areas in the 2nd image frame

Mask for FFT based correlation

M+2δ

M+2δ

δ   N   δ

δ   N   δ

Full image size.............:   (M+2δ) x (M+2δ) pixels
Smallest interr. area size...:   N x N pixels
Search length...............:   δ x δ pixels
No. of spatial hierarchy
levels......................:   S

20

FIG. 5

NO IMAGE COMPRESSION

FIG. 6a

WITH IMAGE COMPRESSION

FIG 6b

FIG. 7a

1st Image Block

FIG. 7b

2nd Image Block

FIG. 7c

Cross-Correlation Plane
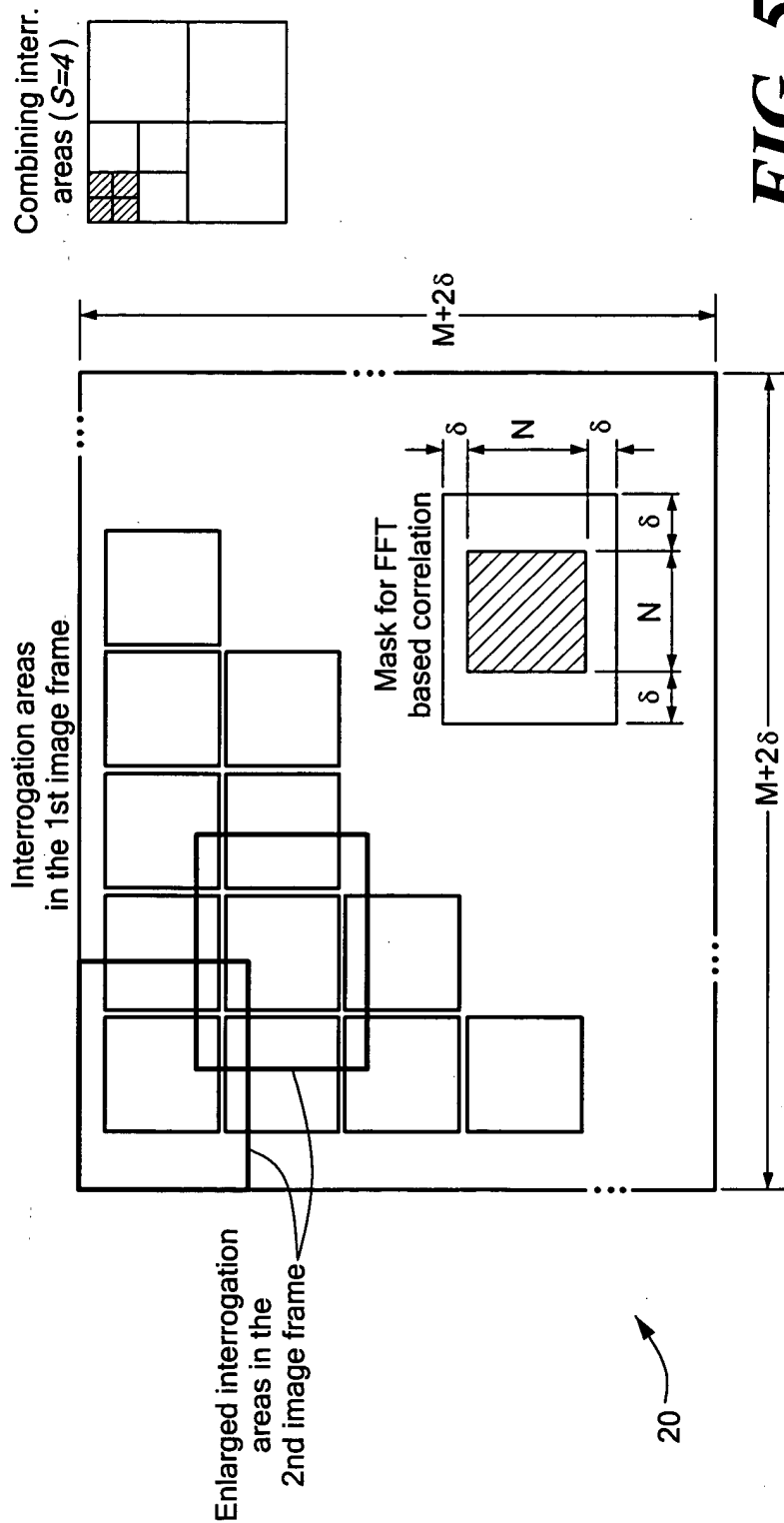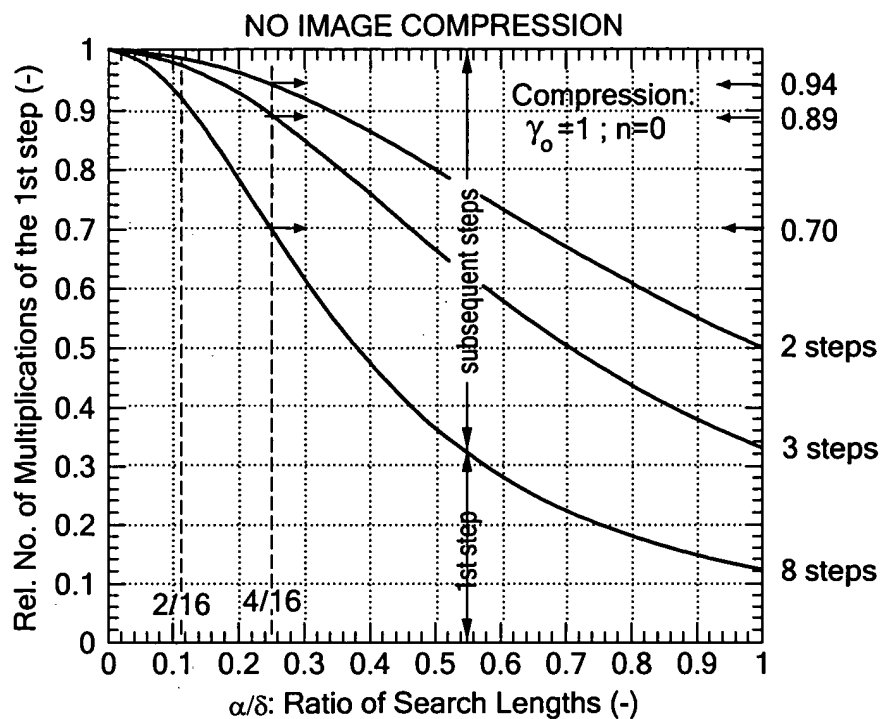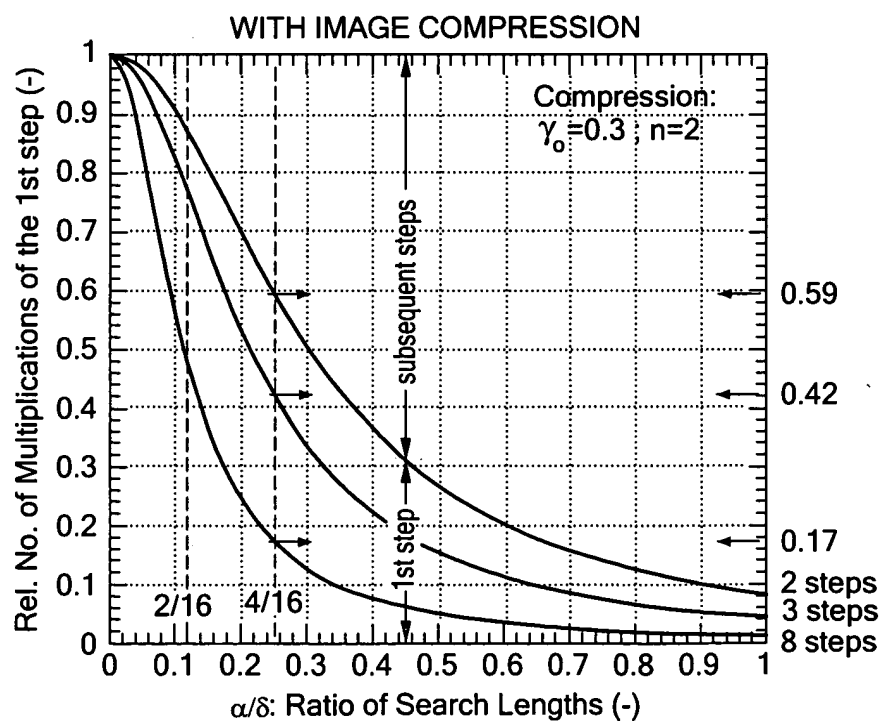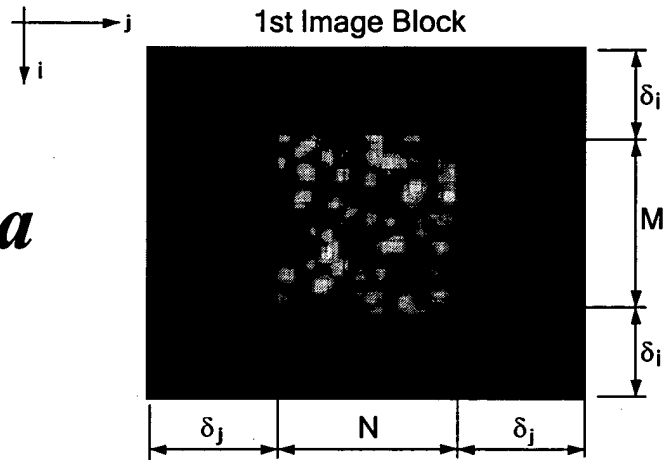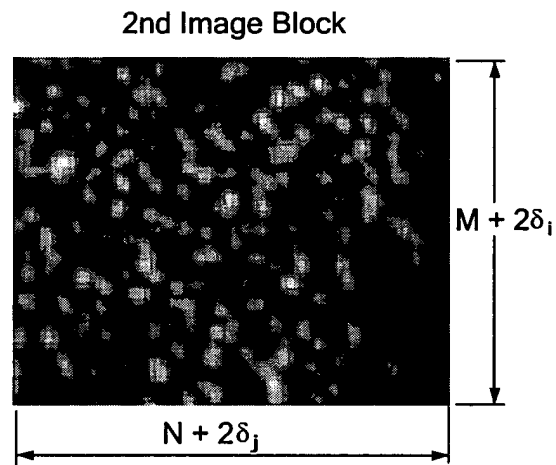
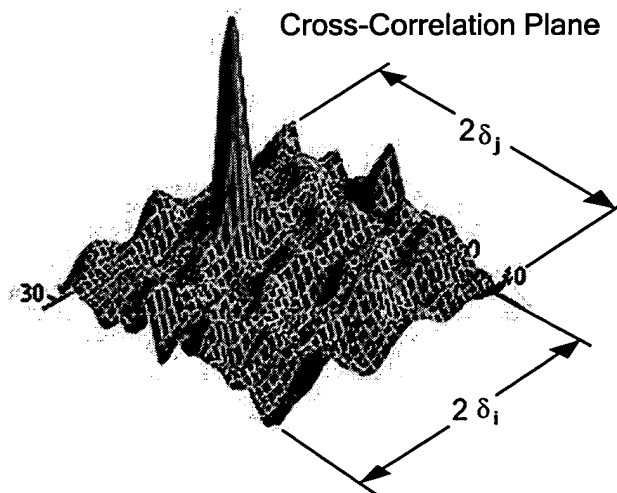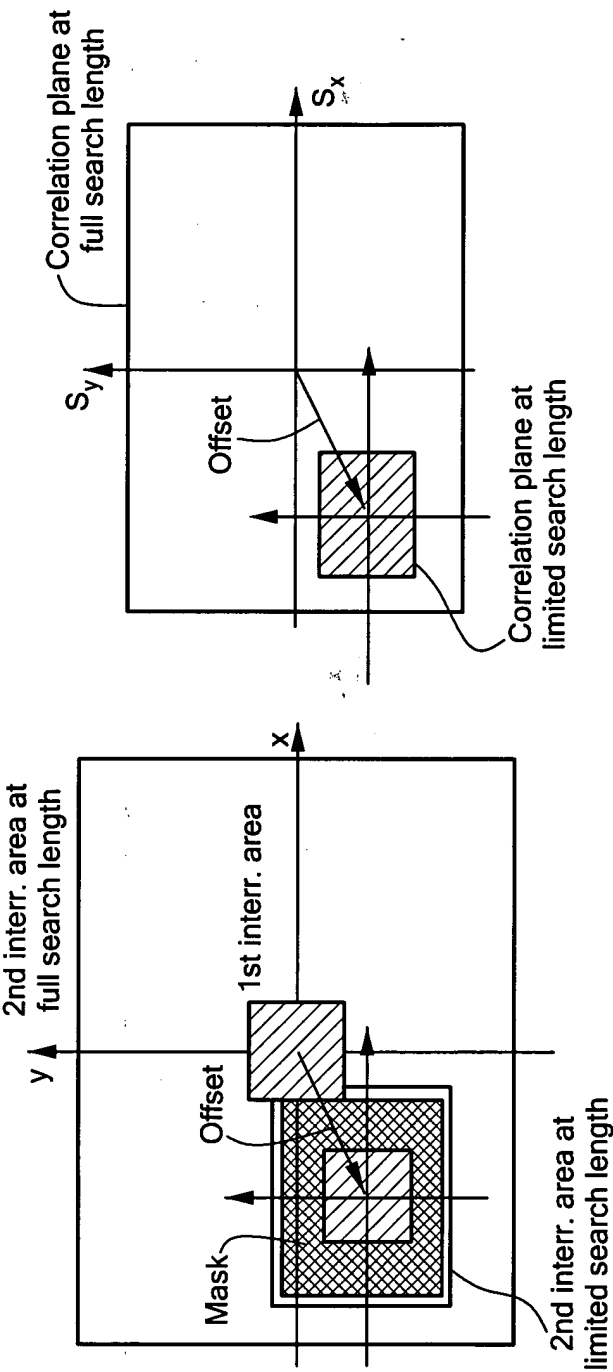*FIG. 8*

Original Image Frame
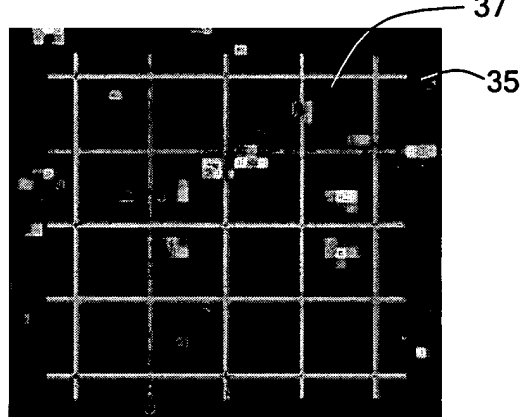
FIG. 9a

Interrogation Areas on Uniform Mesh

FIG. 9b

Combining Interrogation Areas
based on Signal Content

FIG. 9c
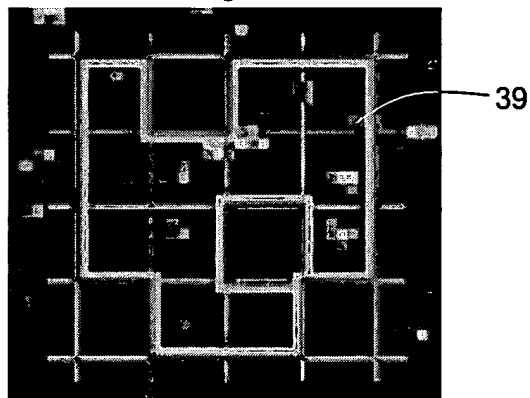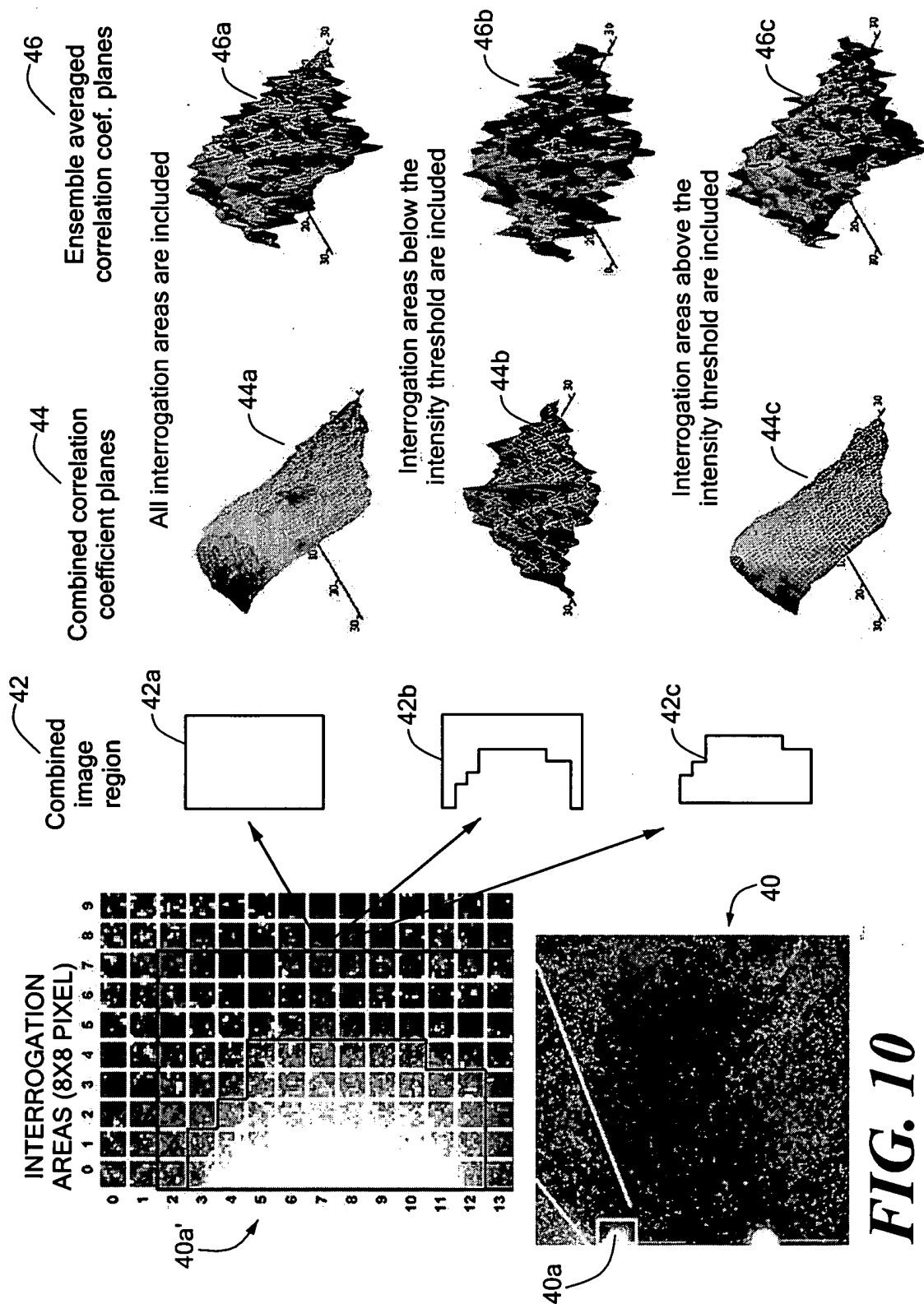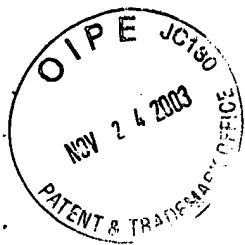
FIG. 10

VJS PIV STANDARD IMAGE #23: 3D JET IMPINGEMENT/DENSE PARTICLE
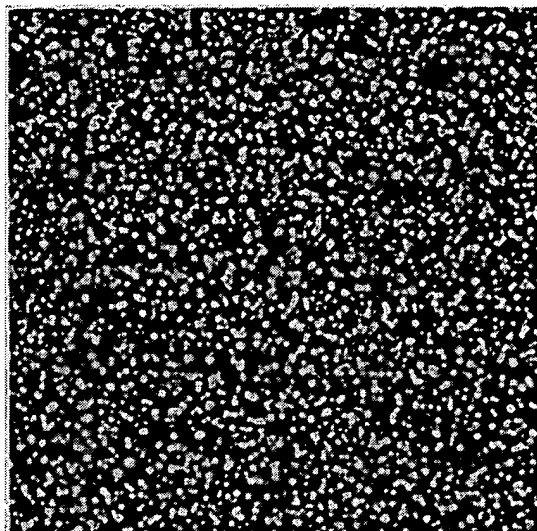First Image Frame

FIG. 11a

VJS PIV STANDARD IMAGE #23: 3D JET IMPINGEMENT/DENSE PARTICLE
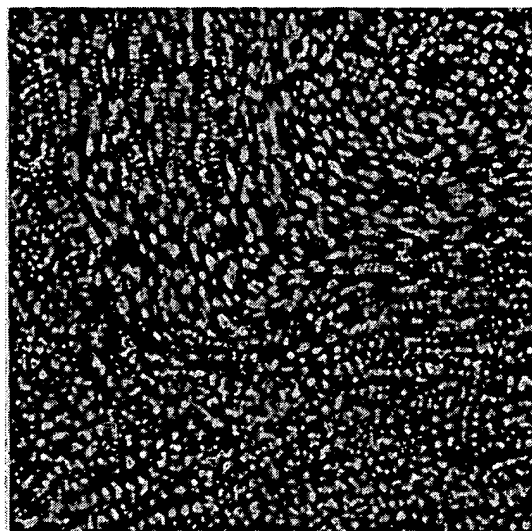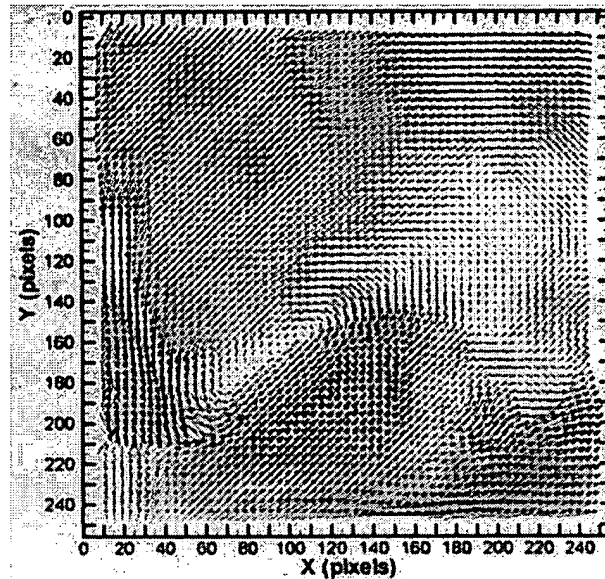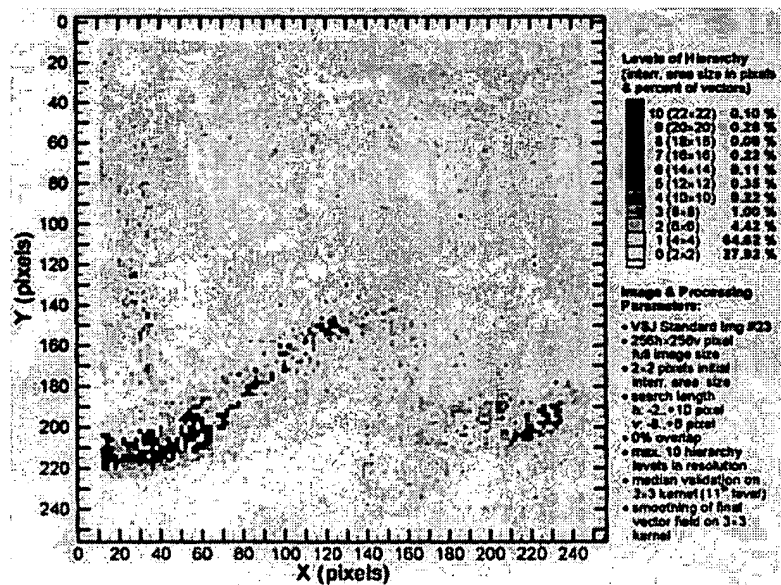Overlaid 1st and 2nd Image Frames

FIG 11b

Vector Field on a Regular Mesh

FIG. 11c

Distribution of Interrogation Area Size

FIG. 11d

HIGH REYNOLDS NUMBER SWIRLING
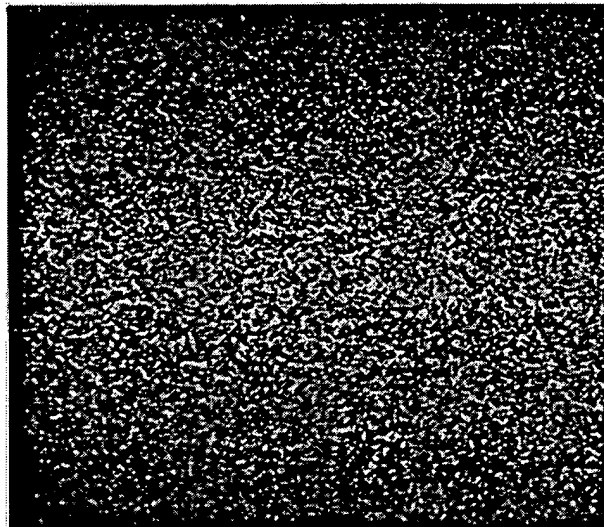FLOW UNDERGOING SUDDEN EXPANSION
First Image Frame

FIG. 12a

HIGH REYNOLDS NUMBER SWIRLING
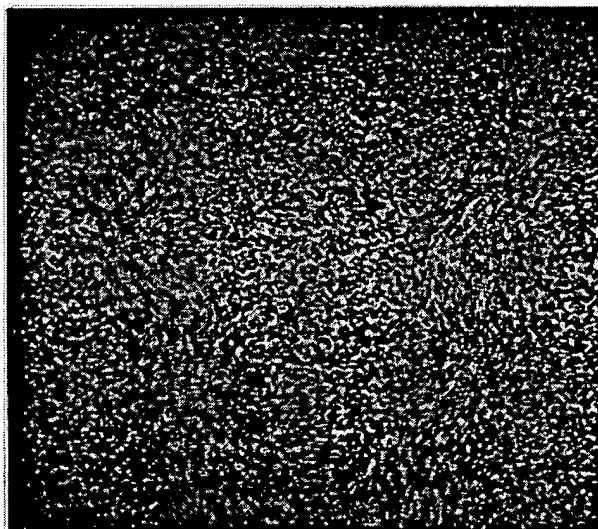FLOW UNDERGOING SUDDEN EXPANSION
Overlaid 1st and 2nd Image Frames
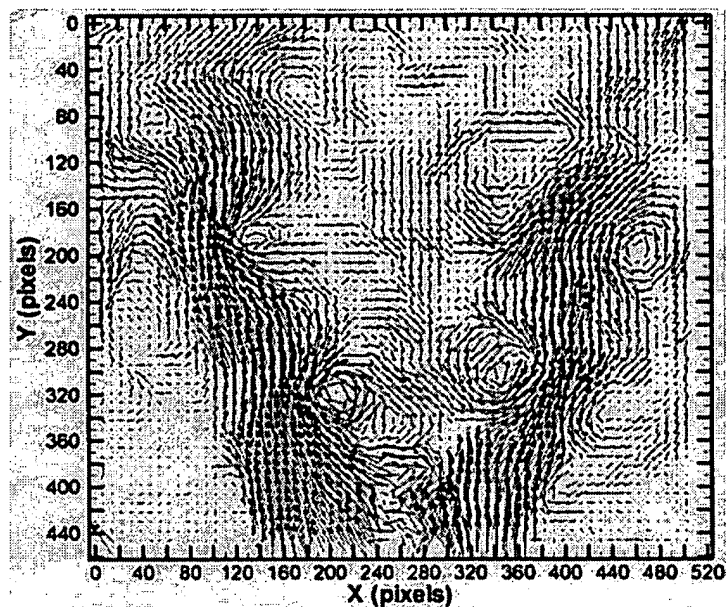

FIG 12b

Vector Field on a Regular Mesh

FIG. 12c

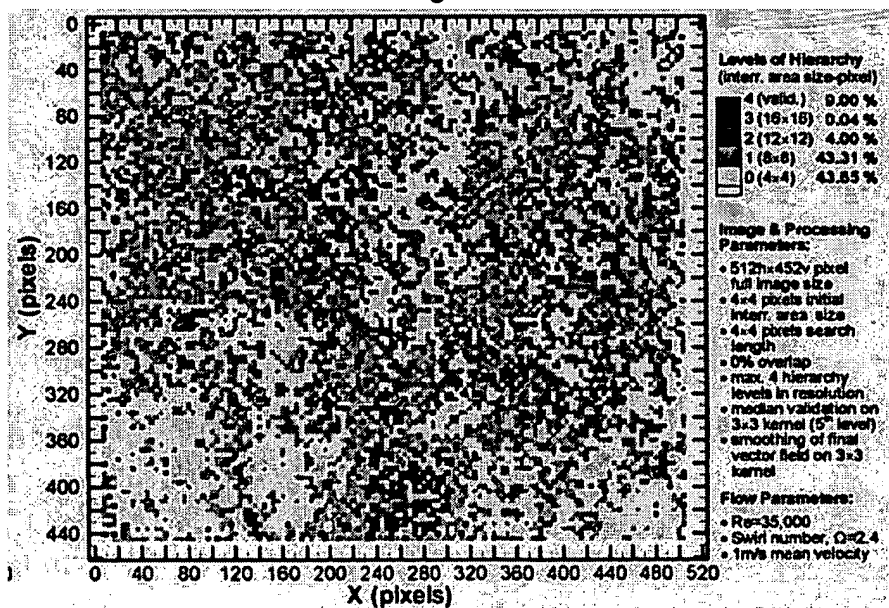Distribution of Interrogation Area Size

FIG 12d